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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/605,319	09/22/2003	David G. GRIER	12962.0008.DVUS01	2318

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EXAMINER	
LAVARIAS, ARNEL C	

ART UNIT	PAPER NUMBER
2872	

DATE MAILED: 11/21/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/605,319	GRIER ET AL.	
	Examiner	Art Unit	
	Arnel C. Lavarias	2872	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 September 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-22* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-22* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *14 September 2005* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The drawings were received on 9/14/05. These drawings are objected to for introducing new matter, and thus have not been entered into the record. See MPEP 608.02(h) and 608.04. In the instant case, Applicants have proposed to add Figure 3B, which shows the DOE without the telescoping lenses L1, L2 and which Applicants believe is supported by the specification at Pages 11-12, Paragraphs 0043-0044. However, in reviewing Paragraph 0044 for this particular embodiment, the Applicants specifically disclose that the DOE be placed directly in the plane containing point B. However, proposed Figure 3B clearly does not show the DOE (See 40 in Figure 3B) being placed directly in the plane containing point B, which happens to be located at the back aperture of objective lens 20.

Response to Amendment

2. The amendments to the specification of the disclosure in the submission dated 9/14/05 are acknowledged and accepted.

Response to Arguments

3. The Applicants argue that the specification of the disclosure does provide antecedent basis for the subject matter recited in Claims 11 and 22. The Examiner again respectfully disagrees. As previously stated in Section 7 of the Office Action dated 3/15/05,

Paragraph 0038 of the instant application only recites that the diffractive element may be disposed in a plane that is conjugate to the back aperture of the objective lens. The plane conjugate to the back aperture of the objective lens and a back/rear focal plane of the objective lens are not the same plane, as specifically shown in Figure 3 of Applicants' own disclosure. In Figure 3, the plane conjugate to the back aperture (See 24 of Figure 3) is denoted as 42. However, a rear focal plane of the objective lens is located in the telescope region between lenses L1 and L2 in Figure 3. The Examiner specifically notes that a rear focal plane of an optical element, such as a lens, must include a focal point of that particular optical element. Applicants' figures, particularly Figures 3-6, merely discloses the diffractive optical element (i.e. DOE 40) being place in the beam path that is collimated and possibly located at a plane conjugate to the back aperture of the objective lens 20.

4. Applicant's arguments filed 9/14/05 (See specifically Pages 10-13) with respect to the rejections of Claims 1-22 in Sections 11-15 of the Office Action dated 3/15/05 have been fully considered but they are not persuasive.

5. The Applicants argue that, with respect to Claims 1 and 12, and similarly to Claims 2-11, 13-22 which depend on Claims 1 and 12, the combined teachings of Neal and Schütze fail to teach or reasonably suggest applying the at least one laser beam to diffraction means for simultaneously creating a plurality of separate laser beams from each of the at least one laser beam, and establishing an optical gradient for each of the plurality of separate laser beams to form a plurality of separate optical traps for moving the plurality of particles. The Examiner respectfully disagrees. It is specifically noted that the test for

obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). In the instant case, Neal already discloses the step of applying at least one laser beam to diffraction means for simultaneously creating a plurality of separate laser beams from each of the at least one laser beam (See specifically 26, 18, 12 in Figure 4 of Neal). In addition, Neal discloses the step of establishing an optical gradient for each of the plurality of separate laser beams to for a single optical trap, or cage, for moving a single particle (See specifically 12, 14 in Figure 4; Figure 3 of Neal; col. 5, line 50-col. 6, line 15, wherein each focal spot produced by the diffractive optical is an optical gradient that exerts a constraining force on the particle). As previously stated in the rejection in Section 11 of the Office Action dated 3/15/05, Schütze is being relied upon for the general teaching that plural traps may be formed and utilized, and that such plural traps may operate on more than a single particle. The Examiner additionally notes that though Neal requires at least three focused beams to create a stable optical cage, and Applicants appear to argue a one-to-one correspondence between the number of laser beams and the number of optical traps, Claims 1 and 12 do not specify any particular correspondence between the number of separate laser beams formed by the diffractive means and the number of separate optical traps formed by the separate laser beams. With regard to arguments that Neal teaches away from multiple beams forming multiple light cages, the

Examiner notes that no such recitation is actually disclosed or recited in Neal, and at most, Neal is merely silent with respect to forming multiple light cages and having a plurality of particles.

6. Claims 1-22 are again rejected as follows.

Specification

7. The disclosure is objected to because of the following informalities:

Paragraph 0027, line 1- 'FIGURE 3A and FIGURE 3B' should read 'FIGURE 3'

Paragraph 0038, line 1- 'FIG. 3A' should read 'FIG. 3'

Paragraph 0041, line 1- 'FIG. 3A' should read 'FIG. 3'

Paragraph 0043, line 3- delete '(see FIG. 3B)'.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 1-2, 4, 6-9, 12-13, 15, and 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neal (U.S. Patent No. 5939716), of record, in view of Schütze (U.S. Patent No. 5689109), of record.

Neal discloses a method for manipulating a particle by forming and moving a plurality laser beams forming an optical trap or cage (See for example Figure 4, 6), the method comprising providing at least one laser beam from at least one source (See 26 in Figure 4); applying the at least one laser beam to diffraction means for simultaneously creating a plurality of separate laser beams from each of the at least one laser beam (See 18 in Figure 4); establishing an optical gradient for each of the plurality of separate laser beams to form at least one optical trap or cage for trapping and/or moving the particle (See col. 5, line 50-col. 6, line 36); and performing a manufacturing process which changes the position of the particle (See col. 8, lines 7-40). Neal also similarly discloses the manufacturing process being, for example, manipulating the structure of biological materials (See col. 8, lines 7-40); the step of establishing an optical gradient comprising the step of focusing at least one of the laser beams (See 24 in Figure 4); the step of moving the particle comprising the step of dynamically changing locations of the optical trap or cage (See col. 2, line 49-col. 3, line 8); moving the particle by translating at least one of laterally and axially the optical trap relative to an optical axis (See col. 2, line 49-col. 3, line 8); converging selected ones of the laser beams and forming the optical trap at spatial locations either in the focal plane or out of a focal plane of an objective lens (See 18, 24, 28 in Figure 4); moving the particle by moving a sample stage relative to a specimen comprising the trapped particles (See col. 2, line 49-col. 3, line 8); and at least one focusing element (See for example 36, 24 in Figure 4; Objective with Z-drive in Figure 6). Neal lacks the particle being a plurality of particles and the optical trap being a plurality of optical traps. However, it is well known and conventional in the art to

perform such particle manipulations utilizing optical traps wherein a plurality of particles is provided and wherein a plurality of optical traps is utilized to perform the manipulations. For example, Schütze teaches an apparatus and method for manipulating small biological particles utilizing one or more optical trapping beams (See Figure). In particular, Schütze teaches one particular embodiment wherein each of two or more infrared laser beams (See 4 in Figure; col. 4, line 55-col. 5, line 11) create an optical trap to trap and manipulate multiple individual biological particles (See col. 6, line 66-col. 7, line 67). The particles may be manipulated individually by controlling individual traps, or the particles may be manipulated as a group, such as by controlling the individual traps together or moving the sample stage (See col. 6, line 66-col. 7, line 43). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have the method of Neal manipulate a plurality of particles by forming and moving a plurality laser beams forming a plurality of optical traps or cages (i.e. utilizing 3 or more laser beams per particle to create each optical cage for each particle), as taught by Schütze, for the purpose of providing simultaneous, and possibly independent, manipulation of the plurality of particles, thus reducing process time (i.e. time multiplexing, moving 2 or more particles at a time vs. moving a single particle at a time).

10. Claims 3 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neal in view of Schütze as applied to Claims 1 and 12 above, and further in view of Long (U.S. Patent No. 5986781), of record.

Neal in view of Schütze discloses the invention as set forth above in Claims 1 and 12, except for the diffraction means being a time-addressable phase-shifting medium.

However, as is known in the art, diffractive optical elements may be implemented utilizing liquid crystal spatial light modulators (SLM) or displays. For example, Long et al. teaches a liquid crystal display (See for example 68 in Figure 1) which dynamically received computer-generated data and displays such data (See entire document, especially Abstract). Each data corresponds to an optical characteristic, such as an amplitude or phase, to be applied to the incident light. Further, the SLM may be addressed in real time. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have the diffraction means be a time-addressable phase-shifting medium, as taught by Long, in the method for manipulating a plurality of particles of Neal in view of Schütze, to provide continuous, real-time adjustments to the optical characteristics of the diffraction optical element.

11. Claims 5 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neal in view of Schütze as applied to Claims 1 and 12 above, and further in view of Sasaki et al. (K. Sasaki, M. Koshioka, H. Misawa, N. Kitamura, H. Masuhara, 'Pattern formation and flow control of fine particles by laser-scanning micromanipulation', Opt. Lett., vol. 16, no. 19, October 1, 1991, pp. 1463-1465.), of record.

Neal in view of Schütze discloses the invention as set forth above in Claims 1 and 12, except for the step of applying to the plurality of laser beams a transfer optical element which interacts with the laser beams to transfer an optical point of an optical train to another optical point location. However, the use of such transfer optical elements, such as relay optics and telescope optics are known in the art of microscopy. For example, Sasaki et al. teaches a laser scanning micromanipulation microscope apparatus based on

optical trapping technique (See for example Figure 1), wherein a telescope or relay optical system (See L1, L2 in Figure 1) is utilized in the beam path. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have the method of Neal in view of Schütze include the step of applying to the plurality of laser beams a transfer optical element which interacts with the laser beams to transfer an optical point of an optical train to another optical point location, as taught by Sasaki et al., for the purpose of providing beam diameter matching and image relaying capabilities.

12. Claims 10 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neal in view of Schütze as applied to Claims 1 and 12 above, and further in view of Sasaki et al.

Neal in view of Schütze discloses the invention as set forth above in Claims 1 and 12, except wherein the performing the manufacturing process comprises the step of moving the plurality of particles by moving the plurality of laser beams and associated ones of the optical traps by action of a mirror disposed at a point conjugate to a back aperture of a focusing element. However, as is well known, the use and optical placement of scanning mirrors, particularly when used in conjunction with telescopic relay lenses and objective lenses in a microscope system, are known in the art. For example, as stated above, Sasaki et al. teaches a laser scanning micromanipulation microscope apparatus based on optical trapping technique (See for example Figure 1), wherein a telescope or relay optical system (See L1, L2 in Figure 1) is utilized in the beam path. Further, Sasaki et al. teaches the use of one or more scanning (galvano) mirrors to provide beam scanning and hence

optical trap movement. The scanning mirror (See in particular the second galvano mirror in the beam path in Figure 1), the telescopic relay lenses (See L1, L2 in Figure 1), and the objective (See OL in Figure 1) are configured in such a way that the scanning mirror is disposed at a point conjugate to a back aperture of the objective. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have the manufacturing process step of the method of Neal in view of Schütze further include the step of moving the plurality of particles by moving the plurality of laser beams and associated ones of the optical traps by action of a mirror disposed at a point conjugate to a back aperture of a focusing element, as taught by Sasaki et al., to impart a slight driving force to the trapped particles, thus allowing for easier movement and manipulation of the particles.

13. Claims 11 and 22, as best understood, are rejected under 35 U.S.C. 103(a) as being unpatentable over Neal in view of Schütze.

Neal in view of Schütze discloses the invention as set forth above in Claims 1 and 12, except for the diffractive optical element specifically being positioned in the back focal plane of the focusing element. However, it is noted that the diffractive optical element may be located or placed anywhere in front of/prior to the focusing element, including a location at the back focal plane of the focusing element, so long as the diffractive optical element provides the necessary beam splitting function to the incident optical beam, while still allowing for adjustment of the locations of the optical traps (See 12 in Figure 4 of Neal) in the focal plane (See 28 in Figure 4 of Neal) of the focusing lens (See 24 in Figure 4 of Neal). Therefore, it would have been obvious to one having ordinary skill in

the art at the time the invention was made to have the diffractive optical element be positioned, for example, in the back focal plane of the focusing element, to reduce the size of the diffractive optical element required for beam splitting while providing additional separation between the optical traps in the focal plane of the optical traps.

Conclusion

14. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Arnel C. Lavarias whose telephone number is 571-272-2315. The examiner can normally be reached on M-F 9:30 AM - 6 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Drew Dunn can be reached on 571-272-2312. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

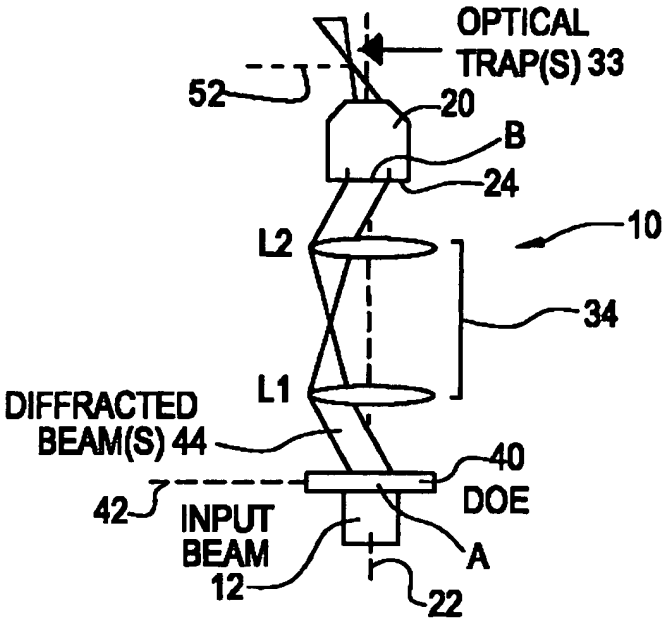
Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Arnel C. Lavarias
11/16/05

THONG NGUYEN
PRIMARY EXAMINER
GROUP 2800

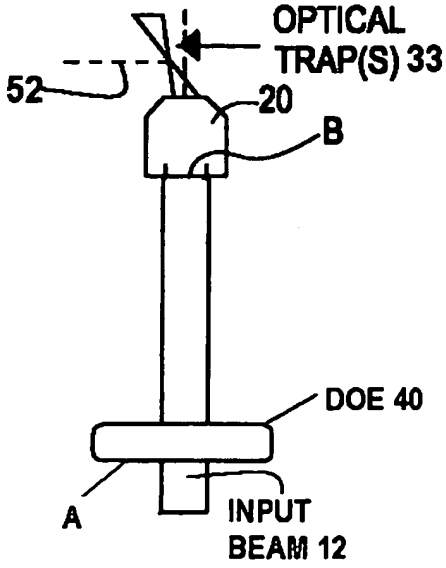
REPLACEMENT SHEET

FIG. 3A



Do Not Enter Act 11/15/05

FIG. 3B



REPLACEMENT SHEET

FIG. 4